

THE NATIONAL SHIPBUILDING RESEARCH PROGRAM

Product Oriented Workforce

U.S. DEPARTMENT OF TRANSPORTATION
Maritime Administration and
U.S. NAVY
in cooperation with
Bethlehem Steel Corporation
Marine Construction Division

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The primary author is Tom G. Black who was Chief of Production Engineering at the Quonset Point Facility of the General Dynamics Electric Boat Division. Shortly after completing the initial drafts of this study, Mr. Black resigned from his position with General Dynamics to accept other employment. Subsequent editing was performed by A. A. Payne, Supervisor of the Production Engineering section at Quonset Point, with assistance and advice from Mr. Frank Long, formerly Chairman of the SP-5 Panel.

This publication is a deliverable for a project managed and cost-shared by General Dynamics Corporation, Electric Boat Division for the National Shipbuilding Research Program under MARAD Contract No. SP 5-85-2. The NSRP is a cooperative effort of the Maritime Administration, the U.S. Navy and the United States Shipbuilding Industry. This project was administered by Panel SP-5, Human Resource Innovation, of the Ship Production Committee of the Society of Naval Architects and Marine Engineers. Frank Long, principal Consultant of the consulting firm Win/Win Strategies was the Chairman of Panel SP-5 at the time the project was conducted.

This project is one part of a broader effort initiated by W. W. Bennett, Division Vice President and General Manager at Quonset, to control and reduce costs through a flexible work force.

Finally, credit is due to L. Safford, who developed the training curriculum for the Pilot Project and managed the 'Cross Trades' jobs, J. Farley, foreman of the 'Cross Trades' work crew, and the Quonset Team Members who performed the work and proved there is merit in the concept.

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SECTION I

EXECUTIVE SUMMARY

This paper represents documentation of an effort by General Dynamics' Electric Boat Division to develop and implement a plan to achieve a multi-disciplined work force at its Quonset Point, Rhode Island Facility. The intent was to determine the mechanics of developing a work force in which employees have more than one skill, identify which skills and what skill levels should comprise an employee's repertoire, then determine the manner in which to assign those employees so that their skills are optimally utilized.

The assumption is that a work crew made up of multi-skilled employees is more productive than its traditional counterpart where each member of a crew is assigned on the basis of his single specific skill for a variety of reasons; most important is the elimination of standby time. The test of that assumption is a comparison of the direct labor costs of both kinds of crews on identical or, at least, similar work.

Because the employees at Quonset Point are not represented by a union, Management has a freer hand making the types of assignments needed to conduct this research than would otherwise be the case.

The issue of cross-crafting has historically been a matter of contention between managements and unions in the shipbuilding industry. Because the cross-crafting to be conducted under this project would not violate the rights provided to an employee or a union under a labor agreement, an opportunity is provided to examine, more or less impartially, whether such cross-crafting is the panacea

many in management believe or a feeble excuse for poor planning as many union representatives believe.

For this reason, among others, the union representatives on panel SP-5 supported this project.

The Product Oriented Work Force or 'Cross-Trades' as they came to be known at Quonset, demonstrated the viability of the cross-craft concept. During the period that cost returns were monitored under the scope of the SP-5 sponsored project, Cross-Trades reduced costs by 15.8% while traditionally organized installation trades reduced costs by 6070, a net difference of 9.8%.

There is little doubt that the consolidation of multiple trades under a vertical management structure was also a significant contributor to the success of the Product Oriented Work Force. While the proposal of the project team for a formal cross-craft apprenticeship program and new labor grade have met with limited management enthusiasm due to cost, Quonset's management structure has evolved into a true Product Oriented Work Force. Direct supervision and mid-management of installation trades along traditional trade lines has been virtually eliminated at Quonset in favor of all skills required to complete a ship's component reporting upward through a single management structure. This fundamental change in management structure provides an environment that will promote the growth and maximize the efficiency of the multi-skilled employee regardless of the direction ultimately taken on training programs and labor classifications.

SECTION II

INTRODUCTION/OVERVIEW

A. Background:

Electric Boat Division of General Dynamics is a submarine design and construction company with facilities in Groton, Connecticut, Quonset Point (North Kingstown), Rhode Island and Charleston, South Carolina. The Quonset Point Facility employs approximately 5,000 people in normal production periods, manufacturing and outfitting hull sections and components of both 688 Class and Trident Class submarines.

The Quonset Point Facility was created to provide added work producing capability to the Groton Facility. Since its inception, Quonset has exercised the flexibility to assign its work force based on the requirements of each individual shop, making it possible to maintain a stable work force. In addition, Quonset Point has provided opportunities for individuals in the

labor force to acquire training in various skill categories. Often, tradesmen receive training in more than one discipline but it was difficult for them to maintain a high level of skill in more than one discipline. In addition, there seemed to be a shortcoming in the system that prevented the company and/or the employee from achieving maximum benefit from the added skill attainment. There was no formal program in place to encourage the employee to pursue more than one skill level and in most shops there was no recognized plan to utilize the skills if they were attained.

Quonset Point Management recognized the potential of having a portion of the members of a work force with skills in more than one discipline. Traditionally, when a specific task was required to be performed, a work team was required to either maintain members with those particular skills or request assis-

tance from another shop. This practice results in under-utilization of skilled employees or in delays while awaiting arrival of needed skills.

Management had made several attempts to maximize the utilization of these employees and at the same time encourage others to acquire multiple skills. Success of this approach came in varying degrees. It became obvious that, if success was to be achieved throughout the Facility, a formal plan had to be adopted and set in place.

The employees had a desire to increase their skill level and the company had a definite need for the multi-skilled personnel; the missing link was a formal program to provide the opportunity, encourage the personnel, and provide assurance that the skills would be maintained and used in the work place. Based on observations where some multi-skilled employees were being utilized, Management felt that the cost of providing the skills would be returned as a result of improved worker morale and subsequent productivity increases.

Panel SP-5 wished to determine the effectiveness and practicality of a multi-disciplined work force. Electric Boat had expressed the same desires and, therefore, elected to provide the opportunity for experimentation in the testing of the effectiveness and the development of a plan for the implementation if the program appeared successful.

B. Theory of Multi-disciplined Work Force:

It has long been assumed that the work force that includes personnel that display more than one skill will be more productive. Under normal environments, work teams often must contain more employees than are actually required on an hour to hour or day to day basis to ensure that the necessary skills are available when required. Other options, such as labor pools, or dispatching skilled laborers from a support shop have not proved to be as beneficial as having the skills on the team. A method of providing the skill without overburdening the labor cost appears to be the challenge.

It was recognized from the beginning that there would be a significant number of problems that would arise from the attempt to establish a work force that could be multi-skilled and at the same time perform all of the required work economically. Of primary concern would be the design of a program that could be maintained in the daily work environment. If successful, this program would have to provide a means for the acquisition of the desired skills, an incentive for the workers to acquire added skills, a skills maintenance program and above all, a method for the company to reduce its' overall production cost as a

result of the program. In order for any program of this magnitude to be successful, it was recognized that there must be total support from the Management as well as from the work force.

Management support for a program that will reduce the overall manufacturing cost is not difficult to obtain if properly presented and the risk does not outweigh the possible gains. Support from the work force must come from acceptance from within. Management must gain the confidence of the workers and convince them that both the company and the worker will gain from such a program.

From the beginning, the Management team at Quonset Point had expressed its support of the design of such a plan. After interviews with some employees, it was determined that such a plan, if properly designed, would be successful.

C. Electric Boat's Approach to Multi-skilled Work Force:

The Management team at Quonset Point had agreed to attempt to design and test a program to determine the viability and acceptance of such a work force.

First, to assure Management that the utilization of a multi-skilled work force would have significant and measurable positive cost impact, the decision was made to assemble a team of multi-skilled employees for a pilot program. This team was to perform a predetermined amount of work utilizing multi-skilled employees. The cost of the same work performed in a traditional way was extracted and recorded for later comparison.

Secondly, a program to supply the skilled work was to be designed to assure that if the multi-skilled employee could assist in significant cost reduction that a ready supply of these individuals could be obtained and maintained. The mere fact that there was a need did not assure that there would be a supply.

If the multi-skilled employee is to be totally utilized there would have to be substantial studies to determine the best mix of skills within an individual as well as a particular crew inasmuch as skill requirements vary from job to job. The work content at the Quonset Point Facility must also be analyzed to assure that there was sufficient work that required the multi-skilled worker to justify the cost of the program.

And finally, if such a program was to be installed Management would have to be assured that the results could be measured and, if successful, that the results could be repeated.

A Pilot Program that would provide answers and data would assist Management in a decision to pursue the project on a larger scale would have to be developed.

and implemented. This Pilot Program would have to be designed to assure that all variables were tested and at the end of the Pilot Program, sufficient data would be compiled to forecast the total cost as well as the

total savings. It would be anticipated that from this Pilot Program the problems that would arise during larger scale implementation would also have ready solutions.

SECTION III

WORK DEFINITION AND NEED FOR CHANGE

A. Work Type:

Work at the Quonset Point facility is typical of other shipyards, with the predominant cost in the area of welding. However, a significant amount of work is performed in the area of outfitting hull sections, decks and component modules. This work consists of the fitting and installation of components such as machinery, pumps, valves, piping, electrical cabinets, bunk rooms, ventilation and lockers. Since the average job in the outfitting environment requires skills in fitting, welding, pipefitting, pipewelding, outside machining, sheetmetal and electrical, the job rapidly becomes more complex and, therefore, normally involves greater numbers of skilled workers. With the skill levels defined and more stable for the welding and fitting portion of the work, the obvious area for improvement appears to be in the piping, outside machining, sheetmetal and electrical work. At the installation phase, the work primarily consists of these trades' involvement.

B. Need for Cross Trades (Multi-skilled Work Force):

In the areas of installation work, such as pump installation, the need for skilled machinists as well as pipe fitters exists for a short period of time. In other instances, such as electrical panel installation, the requirements are for the skills of machinists and electricians and possibly sheetmetal mechanics for a short duration of time. It appears only sensible to provide all of the skill levels necessary to perform the variety of

tasks successfully. At the same time, however, budget considerations will not permit the employment of all of the necessary personnel. Since the duration of the tasks requiring skilled tradesmen is usually intermittent and minimal, it is not economically feasible to retain all of the skilled mechanics all of the time. The obvious solution appears to be to train some of the people in more than one of the skilled areas.

c. Cross-trade Training:

Basic skills such as proficiency in arithmetic, geometry, construction drawing interpretation (Quonset rarely uses shop drawings) and communications are a common core requirement shared by most of Quonset's installation trades. Furthermore, many of the tools and techniques familiar to the mechanic skilled in one trade are common to others. As the skilled worker must have already mastered these basics and requires minimal training to add new skills, he (she) presents the greatest area of opportunity to the company.

The training curriculum for the employees who comprised the multi-skilled work force (who had been trained and working in a cross-skilled capacity long before the start of this project) consisted of forty to sixty hours of classroom work and in some cases, up to forty hours of shop work in the new skill. The remainder of the training was on the job, with the employee gaining experience in the new skill as the work situation warranted. (Appendix E, Exhibit 8, is a sample of the training program.)

SECTION IV

ELECTRIC BOAT'S PREVIOUS ATTEMPTS

A. Implementation:

The Management team at Quonset Point recognized the potential benefit of having workers who possessed multiple skills; however, the program lacked sufficient direction and plan to be effective. The specific supervision of the particular work teams changed a number of times due to the growth that Quonset Point was experiencing. With each change of management, the direction changed slightly until the program was primarily dormant.

B. Employee Morale:

Due to the constant changes and lack of consistent direction, the morale of those employees involved began to deteriorate and a loss of credibility was beginning to show. In addition, the multi-skilled employees felt that their extra skills entitled them to a better labor grade.

C. Assumptions:

Since most members of Management could see the advantages of a program of this nature, it was unclear as to why the program was not as effective as had been predicted. Some basic assumptions had been made that were not proving to be correct. It was felt that the employees would acquire the training and skills without a formal program and the general consensus was that the employees would acquire the training for their own benefit. Another assumption was that the jobs required that the employees be trained to the "skilled" level in each of the disciplines in order for them to be effective. A final assumption was that the employees with multiple skills would be using all of these skills on a routine basis.

D. Results:

It became obvious that the program would not work without a plan that would insure that:

- (1) The objectives of both the company and the employee were met.

- (2) The changes in management direction would be resolved.
- (3) A coordinator responsible to provide continuity be appointed.
- (4) The credibility of the program be reinstated. Although there might be savings involved, future growth of the program was clouded by uncertainty.

E. Company Action:

After being awarded the contract by panel SP-5, a decision was made by the Electric Boat Management to pursue the effort in a more organized manner. A project manager was tasked to form an evaluation team to determine the approach to test the applicability and effectiveness of a program that met all of the objectives. The team was selected and provided with the resources to develop an approach for testing the program and to ultimately provide an implementation plan.

SECTION V PILOT PROGRAM

A. Organization:

The initial organization of the Pilot Project was under the cognizance of the Packaging Department (Operations administrative arm for module outfitting), who designed the initial training program, screened and selected employees and provided initial progress reports to the SP-5 panel. Subsequently, the Production Engineering Department was assigned leadership of the project with team members representing Industrial Relations, trade supervision, training school and Management in Counsel.

B. Charter:

The team was assigned responsibility to determine the following information in order to support management decisions for the future of the program.

- (1) Actual savings as a result of the use of multi-disciplined workers.
- (2) The training requirements for the increased skills.
- (3) The cost of providing such skill training.
- (4) How effectively would the skills be utilized by the trade supervision?
- (5) How to encourage the workers to submit to the training.
- (6) What would be the level of participation of the workers?

C. Procedure for Charter Achievement:

- (1) Savings documentation: The team determined actual cost of work performed by a crew that was made up of cross-trade trained employees. This cost was compared to the same work that had been performed on previous hulls by crews that did not include the cross-trade personnel.
- (2) Training Requirements: The team studied training requirements that would have to be met if the mechanics were to be trained in another skill.
- (3) Cost of Training: After determining the training requirements, the team was able to project the cost of providing a typical skill cross-over.
- (4) Effective Use of Skills: Due to the labor charge system at Quonset Point, the team was able to measure the effective use of the various skills by each employee of the pilot team.
- (5) Measure of Acceptance: During the pilot program, workers on the pilot team and others not on the team were interviewed to determine the level of acceptance and what type of program would be required to increase the acceptance.

D. Results:

- (1) Savings: Actual documented cost savings attributed to multi-skilled work team was 9.5

This savings was achieved with no added administrative or training cost since the workers were already available for the pilot program. Administrative cost was due only to the monitoring performed. (See Exhibits 1 and 2 attached)

- (2) **Training Requirements:** Shortly into the program, the team was able to determine the training that would be required to bring a typical employee to the skilled level in a new field. This study resulted in the development of an Apprenticeship Program that has been considered by Quonset Point Management but not adopted due to cost and labor grade problems. This two-part program would provide the means to allow all employees the opportunity to participate. (See Exhibits 3 and 4 attached)
- (3) **Cost of Training:** Upon developing the Apprenticeship Program, the cost was developed using similar training programs as a cost basis. (See Exhibits 5 and 6 attached)
- (4) **Effective Use of the Skills:** The team was surprised when the results indicated that the predominant

amount of work performed by any mechanic on the team was within his original skill area. While this phenomena was partially caused by the limited size (and therefore workmix) of the Pilot Project and could reasonably be expected to diminish somewhat with broader implementation, the mechanics were not using their secondary skills as much as had been expected. This was of much concern to the team when the facts showed significant savings. (See Exhibit 7)

- (5) **Worker Acceptance:** After reviewing the results of the interviews with the employees, it became obvious that they wanted more than just the opportunity for added training. They wanted to be paid more due to the fact that they were more versatile. The team had forecast this situation and had already submitted a proposal for the new labor grade that would allow for the added pay. The training program was developed with the input from these interviews and was designed to increase acceptance as well as opportunity.

SECTION VI LESSON LEARNED

A. Savings Opportunity:

The savings were available if a properly designed and managed program were to be implemented.

B. Skill Cross-over:

After reviewing the results of the use of secondary skills, the team was convinced that the actual re-

quirements of training the employee to the "skilled" level in more than one area would not be cost effective in most cases. The emphasis of the apprenticeship programs, therefore, would be to maintain a prime skill in each employee with other skills at a "semi-skilled" level. This would provide similar savings to the company while reducing costs (to the company) as well as workers' investment in time.

SECTION VII ELECTRIC BOAT'S PLANS FOR THE FUTURE

While the Product Oriented Work Force Project demonstrated significant savings, it is difficult to distinguish the amount of those savings directly attributable to the multi-skilled employee from the portion attributable to management structure changes required to support such a work force.

The obvious gains in communication, team spirit and reductions in conflicting priorities associated with having all workers on a particular project reporting through a single, vertical management hierarchy rather than traditional trade lines, certainly had a significant impact. The

fact that the savings were achieved while 70% of the manhours spent were in the original skill support this.

Quonset Point has recently revised its assembly management structure to conform to product rather than trade lines. With Quonset Point's union free environment, this management structure should naturally promote a growth in the individual employee's repertoire of skills, flexibility and productivity. The decision to implement the apprenticeship program and labor classification changes proposed by the project team, in lieu of the less formal approach currently in practice, has yet to be made.

EXHIBIT 1

COST REDUCTION ASSOCIATED WITH CROSS TRADES

Legend

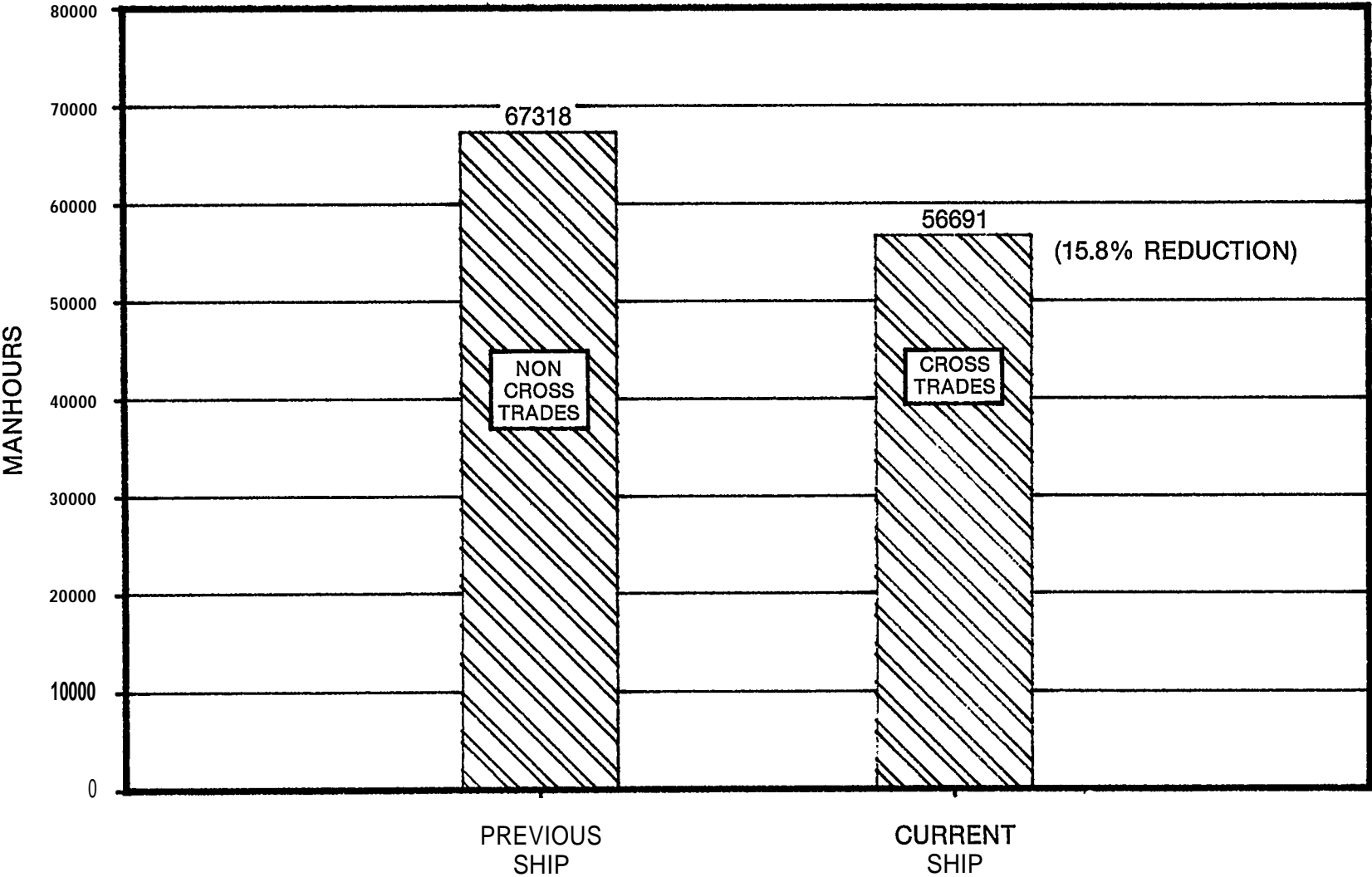
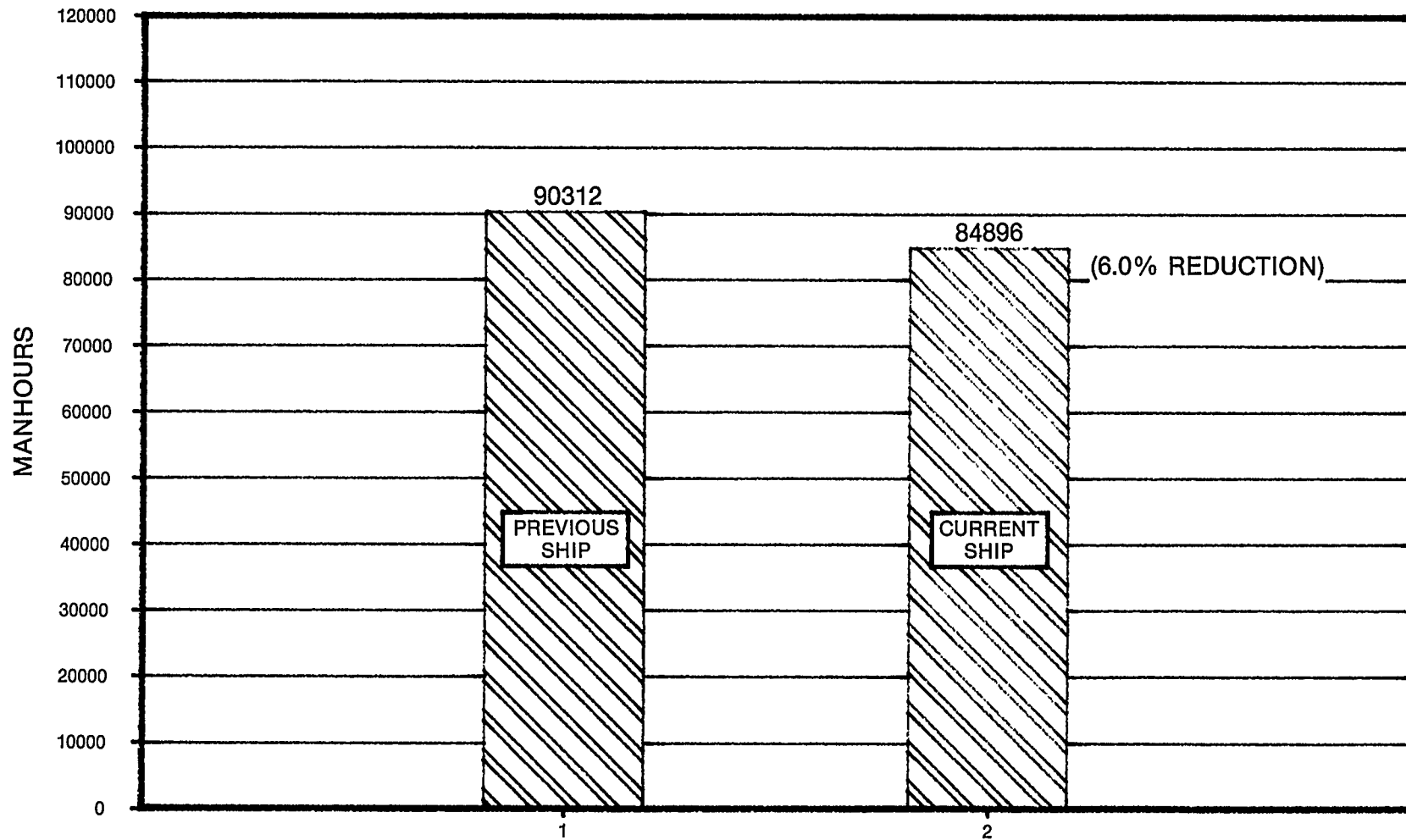


EXHIBIT 2

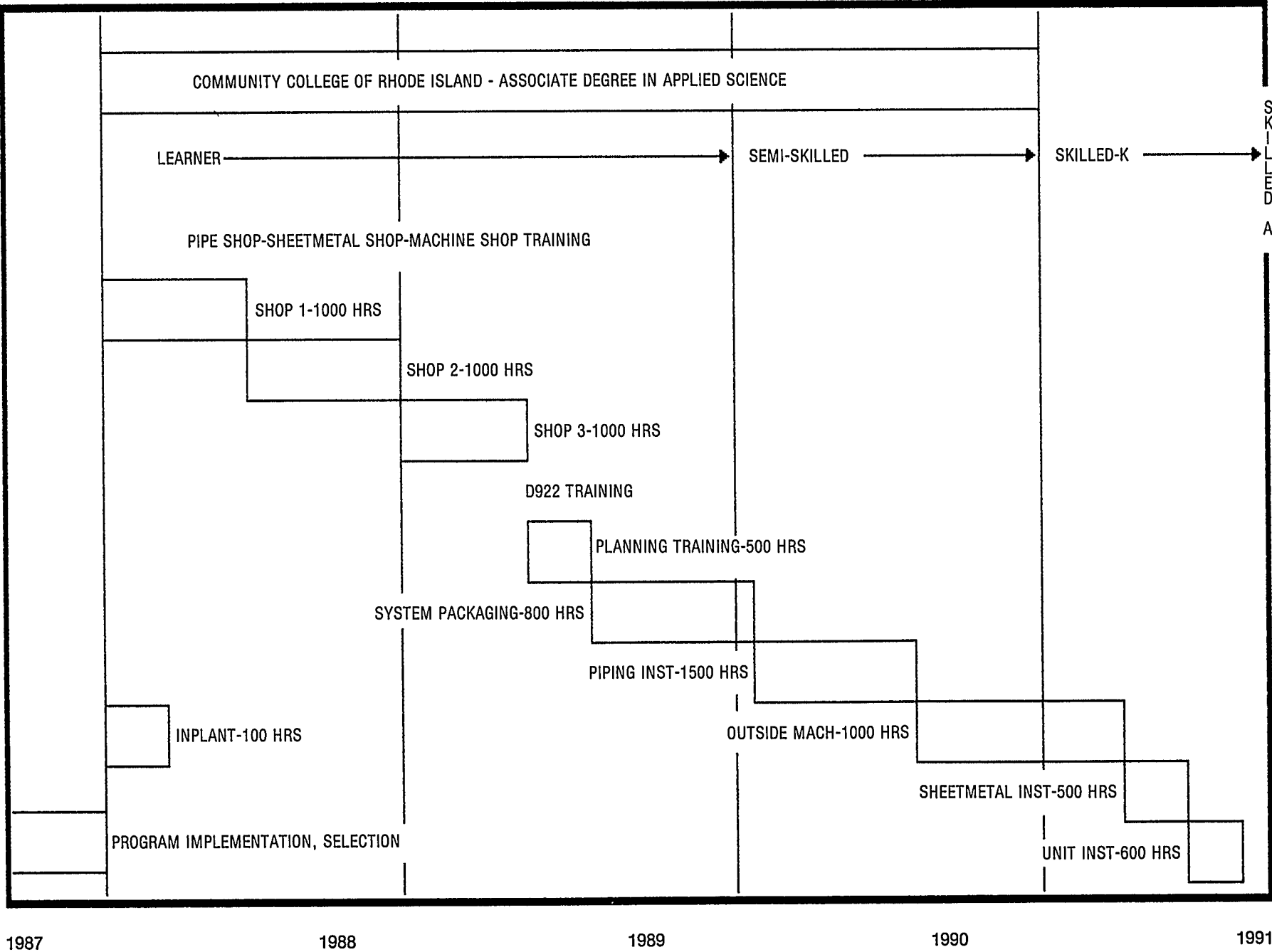
NON CROSS TRADE INSTALLATION COMPARISON
(FOR SIMILAR WORK ACCOMPLISHED DURING THE SAME TIME
PERIOD AS THE CROSS TRADES PROJECT)



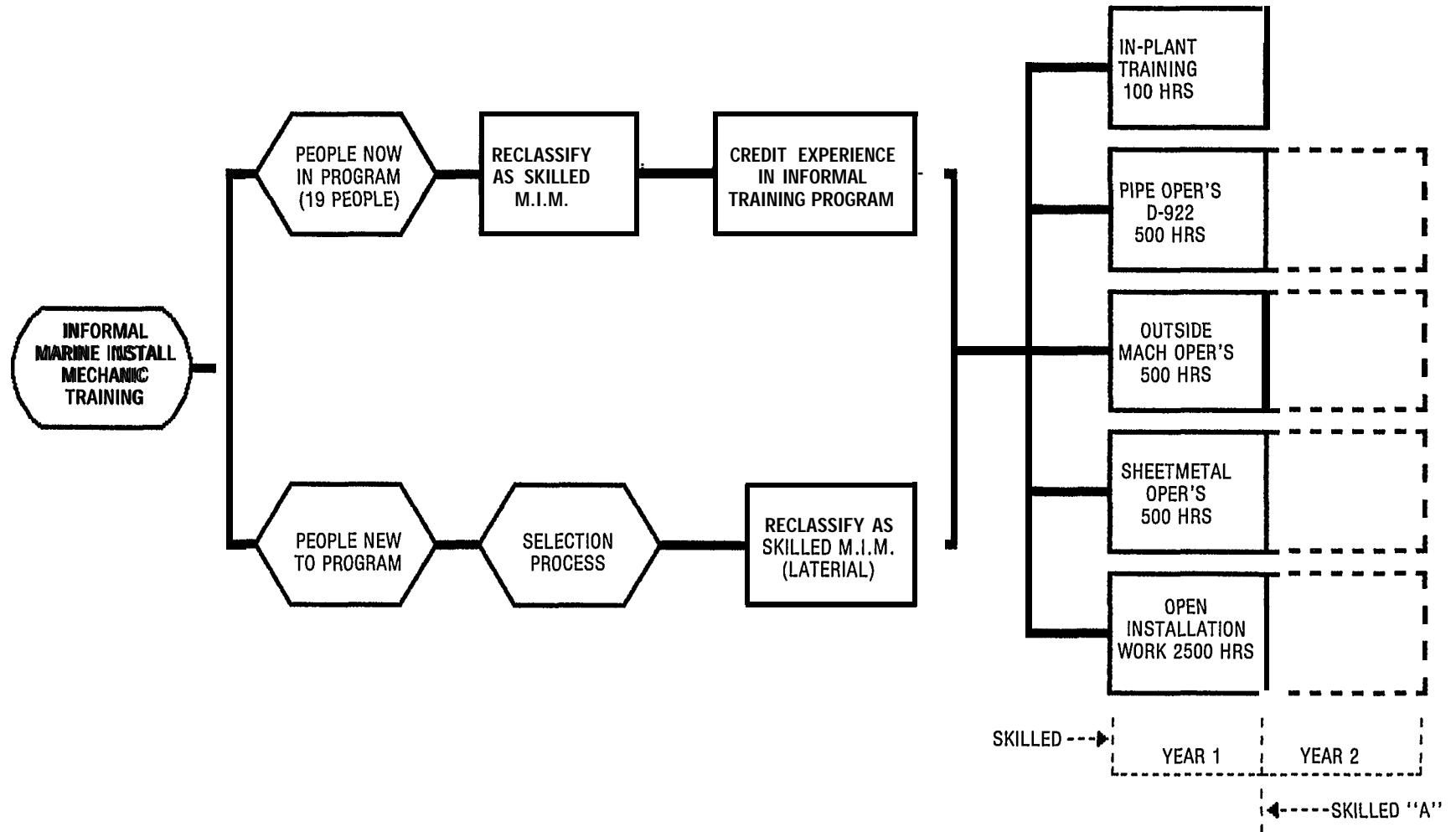
NOTE: 6% REDUCTION IN CONVENTIONALLY ORGANIZED TRADES COMPARED TO 15.8% REDUCTION IN CROSS TRADES

EXHIBIT 3

FORMAL APPRENTICESHIP SCHEDULE
MARINE INSTALLATION MECHANIC
(FOR LEADERS OR SEMI-SKILLED)



INFORMAL APPRENTICE PROGRAM (FOR THOSE ALREADY SKILLED IN 1 TRADE)



CROSS TRADES APPRENTICESHIP PROGRAM

ESTIMATED COST VS BENEFIT

AT \$10/HR REALIZATION

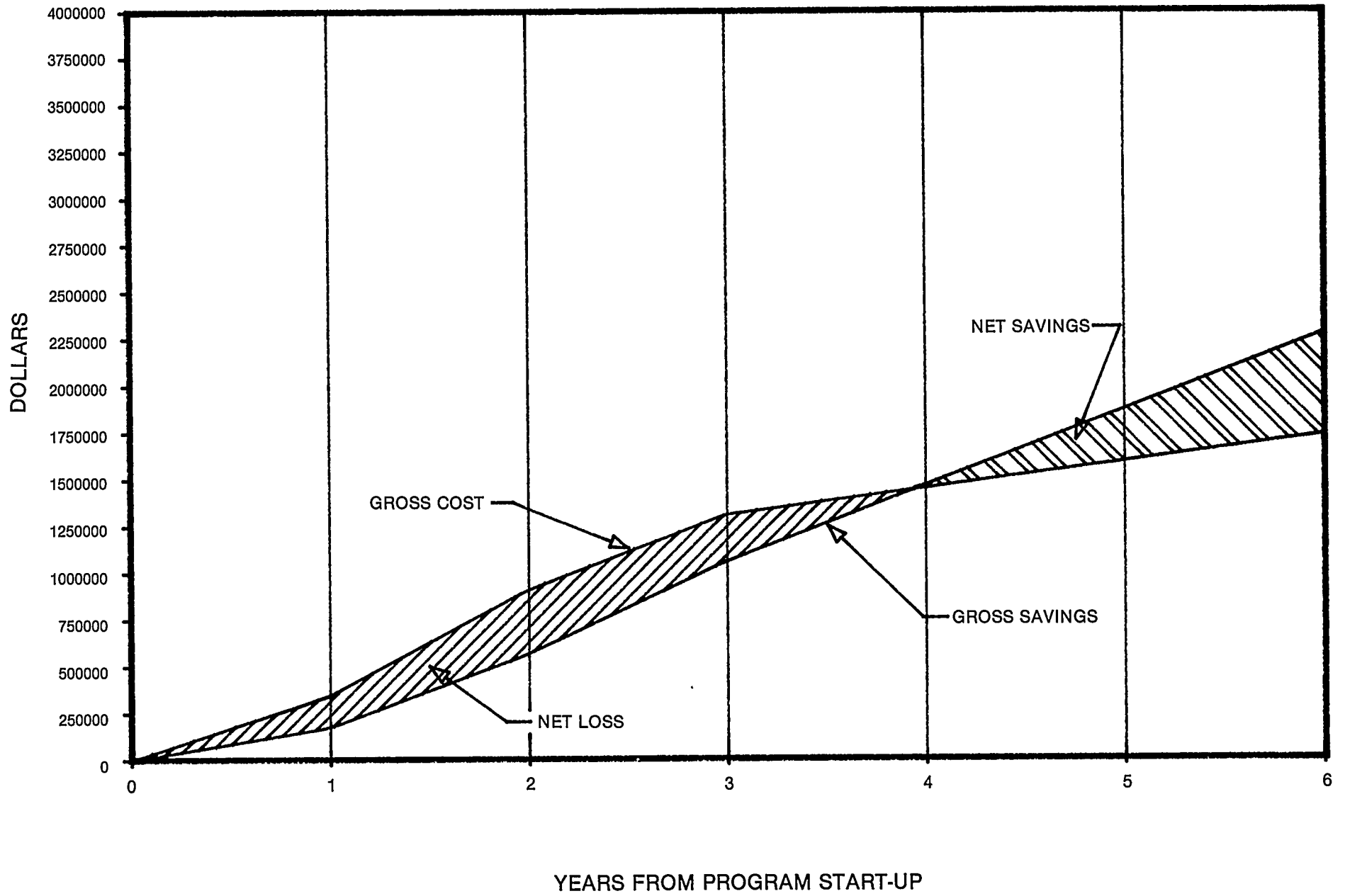


EXHIBIT 6

CROSS TRADES APPRENTICESHIP PROGRAM
ESTIMATED COST VS BENEFIT

AT \$17/HR REALIZATION

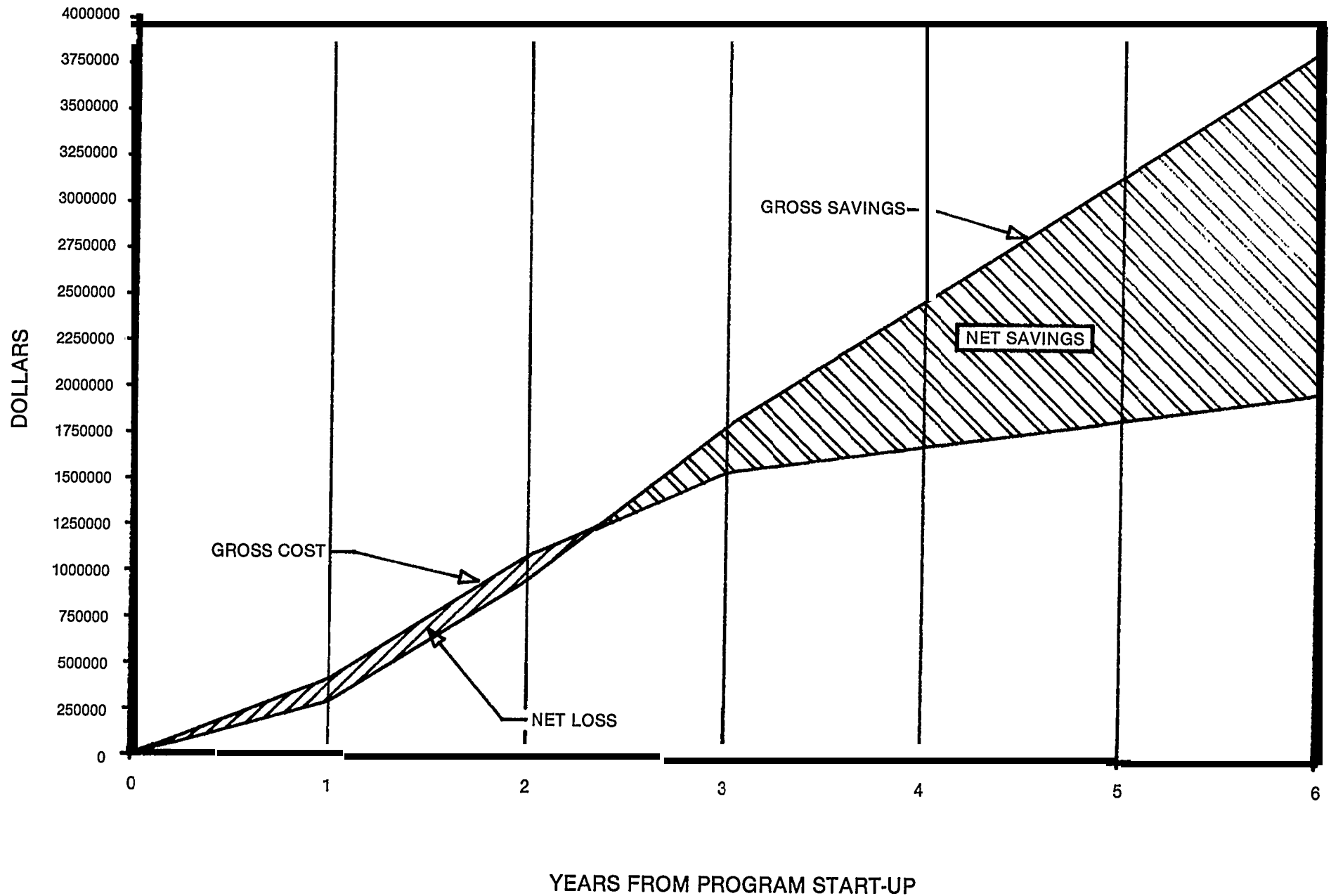


EXHIBIT 7

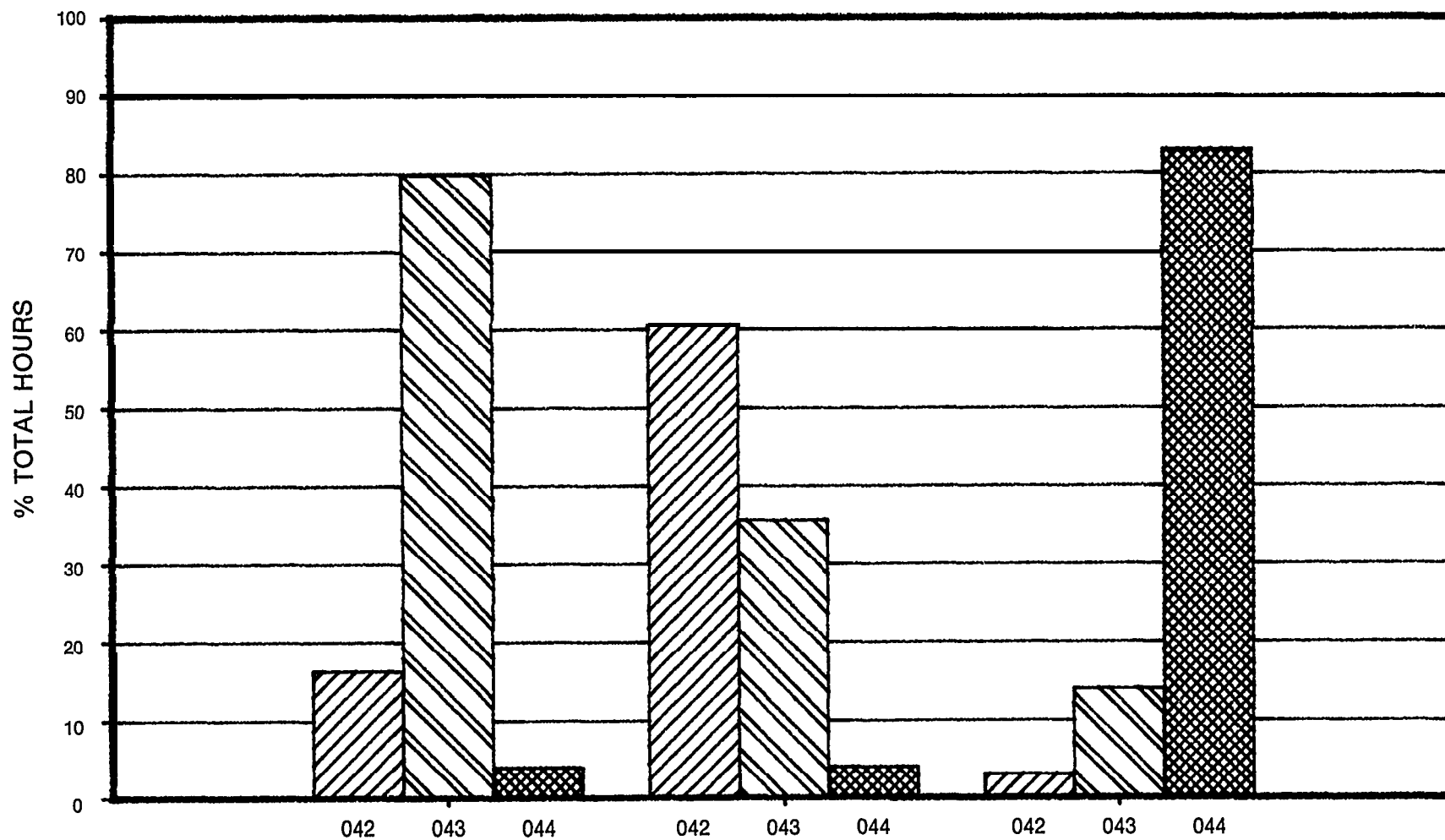
TRADE CHARGING DISTRIBUTION
XTRADES PERSONNEL

Legend

042

043

044



INITIAL TRADE

DISSECTED 042

OUTSIDE MACHINIST 042

SHEETMETAL 044

PACKAGING ASSEMBLER PROGRAM CLASSROOM SCHEDULE

(All classes to be conducted on first shift Wednesdays and Fridays in Classroom K, Building 487)

DATE	TIME	SUBJECT	INSTRUCTOR
OCT. 31 WED.	7:30-8:00	INTRODUCTION	D. BRIGGS
	8:00-8:30	ORIENTATION	R. ODEN
	8:30-10:00	READ AND INTERPRET P/F DRAWINGS	D. BARBER
	10:00-11:00	IDENTIFY ISSUED MATERIAL	D. BARBER
	11:00-12:00	SSP'S FOR PIPEFITTERS (SSP 1.8, 1.8-1, 2.1, 2.4)	D. BARBER
NOV. 2 FRI.	7:00-9:30	PIPE HANGERS (CAPPING AND SEALING OF P/F ENDS)	B. BOWMAN
	9:30-12:00	VALVES (TYPES AND FLOW DIRECTION) MEASURING THREAD STANDOUT BOLTING FLANGES IN SEQUENCE PREVENTIVE MAINTENANCE	G. KAUFFMAN
NOV. 7 WED.	7:00-9:00	READ AND INTERPRET MECHANICAL DRAWINGS	D. PICHE
	9:00-11:30	USE OF MACHINIST MEASURING TOOLS	F. MELONE
	11:30-12:00	QUESTIONS AND ANSWERS	R. ODEN
NOV. 9 FRI.	7:00-8:00	SSP'S FOR MACHINIST PREVENTIVE MAINTENANCE	M. HUBBARD
	8:00-9:00	USE AND TYPES OF SHOCK MOUNTS	M. HUBBARD
	9:00-10:30	SHOCK MOUNT MOVIE	
	10:30-12:00	ELECTRICAL SHOP	S. VEKASY
NOV. 14 WED.	7:00-9:00	READ AND INTERPRET S/M DRAWINGS	R. LETT
	9:00-10:00	SHEETMETAL TOOLS AND SOUND DAMPENING	R. LETT
	10:00-11:30	NOISE CONTROL	J. KOPTONAK
	11:30-12:00	QUESTIONS AND ANSWERS	R. ODEN
NOV. 16 FRI.	7:00-8:00	OPTICAL TOOL - SHOOTING LINES	A. CULLION
	8:00-8:30	PAINT SHOP	W. SMYTH
	8:30-9:30	CENTRAL TRADE PLANNING	V. SIBILLA
	9:30-12:00	CENTRAL TRADE PLANNING	V. SIBILLA
NOV. 21 WED.	7:00-8:30	QUALITY ASSURANCE-INSPECTOR REQUIREMENTS AND INSPECTOR TECHNIQUES	F. McCANN
	8:30-11:00	SUB SYSTEMS	J. WALSH
	11:00-11:30	CRITIQUE	J. ROGERS
	11:30-12:00	QUESTIONS AND ANSWERS	R. ODEN

PAPER NO. 1 SUBMITTED BY RON WEBB
MANAGER OF LABOR RELATIONS
NATIONAL STEEL AND SHIPBUILDING COMPANY (NASSCO), SAN DIEGO, CALIFORNIA

As indicated in the Executive Summary, one of the more appealing aspects of Quonset Point's "Cross Trades" project is its non-union status. That is, unlike a unionized environment, there is absolutely no contractual or jurisdictional restrictions with regards to work assignments. As such, this project represents the use of cross-trading under laboratory-like conditions. Under these conditions, one might have expected the results to be significantly different from similar experiences in unionized environments. Yet, the results were essentially the same.

Contrary to the perception of many people (union and management alike) the idea behind cross trading is not to develop a workforce whereby every employee is capable of performing every aspect of every trade. Clearly, that is not practical. Not only would the cost of such an intense training program be prohibitive, but as was the case at Quonset, employees simply do not utilize the specialized skills of the other trades. They spend the majority of their time performing work within their original trade.

So, how does one explain Quonset's 9.8% improvement in manhours. There are two explanations. One is that by investing a minimal amount of classroom-type training in the other trades, employees are able to utilize these new skills in conjunction with their own trades' skills to perform some of the more basic duties of the other trades, thereby, reducing "standby" time. Secondly, and the more likely explanation, is due to the change in the organization

at Quonset from trade oriented to product-oriented management. This change in the organization coupled with the employees' exposure to the other trades, causes everyone in the organization to be more sensitive as to what impact their actions have on other trades. This generally results in employees communicating with one another. It is the increased awareness and increase in communication that is likely the cause of the greatest portion of the productivity improvement experienced by Quonset.

As mentioned above, Quonset's results were very similar to the results experienced several years ago at NASSCO, a yard with seven different unions. Ref. Multi-skilled, Self-Managing Work Teams in a zone construction environment, (NSRP, #0264). While NASSCO had some contractual jurisdictional restrictions, there was some limited flexibility in work assignments. Like Quonset, NASSCO found that employees spent the majority of their time performing work of their own trade. Yet, there was a significant increase in productivity that was attributed to the increase in communication and a cooperation between the various trades.

By comparing the results of both Quonset and NASSCO projects, maybe some of the fears associated with cross trading (i.e. the elimination of certain crafts and/or a work force comprised of Jacks-of-all-trades, and masters-of-none) will be subsided.

PAPER NO. 2 SUBMITTED BY STEVE WORKMAN
CHIEF SHOP STEWARD
EXECUTIVE BOARD MEMBER, LOCAL UNION 569, IBEW, SAN DIEGO, CALIFORNIA

Certain details of this study seem to be incomplete. For example, does the Savings Documentation, (Reduced Cost of 9.8%) take into account any learning curve that should naturally occur and is usually counted on when budgeting a succession of similar hulls? As the first one is built, mistakes are made and lessons are learned, hopefully, the same mistakes will not be repeated.

Another thing was the fact that employees felt they were worth more due to their increased skills and should be paid accordingly. I've always found this to be a reasonable request, although after reading this report I still couldn't determine if it was ever implemented or just proposed.

While the report states that ... "The Quonset team members proved there is merit in the concept," I found it interesting that it also states that ... "The Team was convinced that the actual requirements of training the employee to the "skilled" level in more than one area

would not be cost effective in most cases. The emphasis of the apprenticeship programs, therefore, would be to maintain a prime skill in each employee with other skills at the "semi-skilled level".

The idea has merit, but as a whole is not cost effective. The apprenticeship mentioned would reduce cost to the company and make better use of trainees time, but has yet to be implemented. With union opposition unavailable as what *might* be an obvious excuse, I have to wonder what team members are being told and how long they'll buy it.

There are also many positives as a result of this project. They seem to be summed up rather well in Section VII, Electric Boats Plan For The Future. The reference to Quonset Point's union free environment is totally unnecessary. The sentence, and the concept, could work just as well without it.